the Glacial period, especially as compared with the fauna of the Alps. Another chapter deals with the distribution of mammals, reptiles, amphibia, mollusca, &c., in the Carpathians, followed by lists of Coleoptera (by Holdhaus and Deubel) found in different districts in the Carpathians, with notices of the surroundings. The map illustrates the glaciation of the eastern Alps and Carpathians during the Ice period, and the range of the blind mountain beetles. These beetles are a specially interesting group, of limited range, in the Austrian Alps. Some of them are cave species, while others inhabit the open.

Many interesting subjects are discussed by Prof. Holdhaus, which we have no space to allude to, but he has not forgotten to take account of fossil and amber Coleoptera, and his remarks on what he calls "Massifs de refuge" (districts south of the Alps to which he believes the mountain species retreated during the Glacial period) also seem to deserve special attention.

*Mosses and Liverworts. An Introduction to their Study, with Hints as to their Collection and Preservation.* By T. H. Russell. New and revised edition. Pp. xvi+211+xiii plates. (London: Sampson, Low, Marston, and Co., Ltd., 1910.) Price 4*s*. 6*d*. net.

THE speedy demand for a second issue of Mr. Russell's book testifies to its value and usefulnes as a guide to the study of mosses and hepatics. The introductory portion is all that can be desired, and the student who conscientiously masters this portion will be in a position to pass on to more advanced books dealing with the same subject. The author lays much stress on the point that he is specially anxious to use simple language, fearing that scientific words might act as a deterrent to the study. With this frequently expressed idea we do not quite agree; the true value of a scientific term consists in the fact that, when once grasped, it stereotypes the particular structure in a single word, whereas a sentence in English may convey but a very vague idea of the structure in question. As an example, the term *archegonium* defines a definite structure, which is said to be "the fruit-bearing organ," which it certainly is not. The species given as examples are well chosen, and cover all the structures peculiar to mosses and hepatics.

The detailed account of habitats, and the stress laid on their importance, are features to be commended, as too frequently the student is encouraged to snatch a fragment from anywhere, put it into a tube containing methylated spirit, and only commence serious study when viewing it under a compound microscope. The chapters on collecting, storing, and the preparation of mounted specimens for microscopic work are very full, and are obviously the outcome of much practical experience.

Thirteen whole plates of excellent figures add much to the value of the book, which can be confidently recommended as a stepping-stone to the study of mosses and hepatics.

*The Social Guide,* 1911. Edited by Mrs. Hugh Adams and Edith A. Browne. Pp. xxxviii+252. (London: A. and C. Black, 1911.) Price 2*s*. 6*d*. net.

INFORMATION is given in this work of reference not only about occupations for leisure days and hours, but also concerning more serious pursuits. The diary with which the volume begins includes the meetings of the Royal Geographical Society and of the British Association among scientific societies, and the anniversary dinner of the Royal Society. Though it is sometimes a little difficult to understand the principle of selection for the contents of the volume, we notice the activities of the Royal Institution, the Royal Society of Arts, and the Zoological Society are described.

## *LETTERS TO THE EDITOR.*

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

### A Kinetic Theory of Gravitation.

THE subject of Mr. Brush's article in NATURE of March 23 (p. 129) is certainly of profound interest, and will continue to be so until the problem as to the nature of gravitation is solved. Meanwhile, a few questions raised are comparatively simple. Anyone asked, Where lies the energy of a raised weight? must surely reply, "In the æther," *i.e.* in the medium, whatever it is, that is driving the weight down towards the earth. A critic who either doubts or asserts this will not be confused—as Mr. Brush suggests he will be—by the suggestion that the weight might be raised so high as to reach the neutral point between earth and moon—a suggestion which carries with it the tacit questions, "Where is the energy now?" and "What has become of the work done?"—for this case is no more troublesome than the case of a weight raised and hung on a hook. Something—some opposition force—sustains the weight, *i.e.* opposes the pull of the earth, and it matters little whether the opponent be a shelf beneath it or the moon above it. The important thing to understand is the nature of the downward propelling force—indeed, of both the upward and the downward force—in either case.

The question whether the energy of a raised weight is potential or kinetic is of little or no importance. The energy is certainly potential, according to our definition of potential. So is the energy of a strained spring: for there also the atoms are separated against their mutual (cohesive) attraction, and there again the energy really resides in the æther. But that all energy may turn out to be ultimately kinetic—when we come to understand what elastic stress fundamentally is—that proposition is not negatived in the least.

Mr. Brush proposes a shadow theory of gravitation, a modification of Le Sage's theory except that the pressure is supposed due to the non-syntonic impact of waves travelling in all directions, instead of to a bombardment of utterly minute particles flying at random. There is nothing new in a shadow theory, and all such theories are faced with the difficulty of plausibly explaining the absence of noticeable screening—a difficulty which is bound to reduce them to acquiescence in an approximation.

The contribution which Mr. Brush makes to the discussion is the suggestion that the supposed gravitational æther-waves are the result of accumulated thermal radiation from all past and present suns, the wave-lengths having automatically increased during their long storage.

To this view several objections might be urged—one of them being that in that case the constant of gravitation would be secularly increasing; another, that it should be greater in a hot enclosure, say the interior of a sun, than elsewhere; but a more salient obstacle is raised by the inquiry as to which is cause and which is effect. How did the bodies get hot and so radiate? Was not their heat perhaps due to their having clashed together with gravitational energy itself derived from the æther?

The fact is that every question concerning *origin* involves us always in insuperable puzzles, and that is just the main difficulty about gravitation. An atom of matter, by its very existence, sets up a fixed stress in the æther, varying directly as the mass and inversely as the distance—that is only another way of stating the law of gravitation; we are trying to understand the nature and cause of that stress. It appears to be one of the fundamental properties of matter, and until we can understand what is meant by the generation or destruction of an atom—*i.e.* of an electron if that is the fundamental unit—we are hardly likely to understand its gravitational influence more than any other of its fundamental properties—including, perhaps, existence itself.

Let this not be understood as a negative prediction or estimate of impossibility—such predictions are always absurd; it may be that when the structure of an electron

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is understood, we shall see that an "even-powered" stress in the surrounding æther is necessarily involved. What I do feel instinctively is that *this* is the direction for discovery, that what is needed is something internal and intrinsic, and that all attempts to explain gravitation as due to the action of some external agency, whether flying particles or impinging waves, are doomed to failure; for all these speculations regard the atom as a foreign substance—a sort of "grit" in the æther—driven hither and thither by forces alien to itself. When, some day, we understand the real relation between matter and æther, I venture to predict that we shall perceive something more satisfying than that. Oliver Lodge.

University of Birmingham, March 25.

### Visual Sensations from the Alternating Magnetic Field.

There is no necessity to look to suggestion or other abstruse causes to account for this phenomenon. The electric currents induced in the head are quite sufficient to produce the effect.

As I pointed out in a letter to *The Electrician* on April 22, 1910, electrodeless currents in the body produced by electromagnetic induction from a coil carrying so-called high-frequency currents have been in use in medical practice for some years.

Employing as primary a coil of wire of many turns, and some 2 feet in diameter, carrying high-frequency currents from the discharges of a large battery of Leyden jars, and using as secondary the body and the two arms bent so as to form a circle, sufficient current can be induced in the circuit formed by the arms and body to light a miniature incandescent lamp connected between the two hands, or a sufficient difference of potential can be produced between the two hands to cause small sparks to pass visibly between them when they are held near together.

It is easy to produce the visual flickering effect by passing through the head the current from an ordinary continuous-current magneto generator, such as is supplied with the Evershed ohm-meter. One terminal of the generator should be held in one hand, while a wire from the other terminal should be held in the other hand in contact with a small piece of wet sponge, and the latter pressed lightly on one side of the head just behind the eye. If the generator handle is then slowly turned (and it is wise to turn it slowly to avoid unpleasant results) the flickering effect will at once become very noticeable, and as the frequency of the flicker increases with the speed of revolution, it apparently is connected with pulsations in the current due to the slow revolutions and the few segments on the commutator. The current through the head must be very small, as the bulk of that generated goes from hand to hand through the arms and body.

I first noticed this phenomenon some fifteen years ago when treating myself electrically for neuralgia, but I fancy that the effects of electric currents on vision have been known much longer than that.

Passing electric currents through the head in certain directions also produces a metallic taste in the mouth.

A. A. Campbell Swinton.

66 Victoria Street, Westminster, March 24.

### The Angular Speed of Rotation of a Long-enduring Prominence.

Thanks to the note contained in the "Astronomical Column" of Nature of March 9, my attention has been directed to the very interesting article under the above heading in the January issue of the *Astrophysical Journal.*

The prominence Mr. Evershed describes is the same as that under consideration in my letter contained in Nature of February 23, and of which disc-spectroheliograms were given in the issue of February 2 in connection with the reproduction of M. Deslandres' address of June 12, 1910. The Meudon spectroheliograms add thus a plate to the series enumerated by Mr. Evershed on p. 3 (*Astrophysical Journal*, No. 1, vol. xxxiii.), and an additional date is further added by the spectroheliogram taken at Meudon on April 15, 1910. Both are beautifully reproduced in the fine memoir forming vol. iv. of the *Annales* of the Obs. d'Astr. Physique de Paris, of which M. Deslandres is the author.

The Meudon spectroheliograms seem greatly superior to those accompanying Mr. Evershed's article in the *Astrophysical Journal*, undoubtedly on account of the excellent and original instrumental combination resorted to by M. Deslandres, which aims at *the absolute isolation of the central rays* $K_3$ *of calcium or of* H*α of hydrogen.* Comparing the Meudon spectroheliogram of March 21 with what Mr. Evershed says (p. 5) as regards the appearance of the dark formation under discussion, one cannot help being struck by the seeming divergence of the evidence. Mr. Evershed says:—"On March 21 it reappears as a *vague* and *ill-defined* dark mass." Further, he states on March 25 that "the northern arm can indeed be faintly traced for a much greater distance in a vast circular sweep towards the eastern limb." Reverting, now, to the Meudon spectroheliogram of March 21, the dark mass is seen of quite immense breadth longitudinally, no fewer than 5 degrees, is pronouncedly distinct in its entire vast extent also latitudinally, shows well-defined western and eastern contours, both convex towards the west, and also shows the narrow extension towards the N.N.E. quite distinctly. This great difference of what the Kodaikánal plate for March 21 shows as compared with the plate taken on the same day at Meudon, creates in my mind a doubt as to the actuality of what Mr. Evershed suggests on p. 6, viz. the disappearance in its entirety of the dark formation between March 25 and 26.

With due deference to the able observer, I venture to say that possibly inaccurate relative setting of first and second slits, along with insufficient dispersive power or other optical inferiority to the Meudon spectroheliograph, has not allowed the Kodaikánal plates to be so sharp and rich in detail as the Meudon plates. This is further suggested by the striking absence on the Kodaikánal plates of many conspicuous dark calcium flocculi, which during those days infested the sun's disc all over, yet, of course, there is the possibility of their temporary absence; but, on the other hand, on each of the successive appearances of the large prominence on the east or west limbs, the formation exhibited the striking feature of a dark, flat cloud hovering over the bright prominence-range along its entire latitudinal extent, as described in my letter, suggesting, therefore, continuity rather than intermittent or "puffing" action. The Meudon plate taken on April 15 clearly shows the re-entry into the disc of the dark formation, with a more acute apex directed towards the west than during the previous transit, and the N.N.E. directed arm is not yet absent as it is on the Kodaikánal plate of April 18.

Incidentally, another exceptional feature of the sun's disc should be mentioned which was strikingly on view during April and May, 1910, viz. the fine circumpolar wreath of dark flocculi in the south. A formation of this kind goes a long way towards explaining the previously puzzling experience of observing for many days in succession prominences at apparently the same position-angles in comparatively low latitudes. These prominences are, as a rule, of the quiescent, brushy, and rather dull type. Albert Alfred Buss.

"Barrowdale," 22 Egerton Road, Chorlton-cum-
Hardy, Manchester, March 19.

### The Flow of Thin Liquid Films.

In the very interesting letter by Mr. W. G. Royal-Dawson in Nature of March 23 on the above subject, the peculiar character of the stream-lines round a moving air bubble compared with those round a fixed solid obstacle may seem to some to require an explanation. As the writer of the letter offers none, may I be permitted to state what appears to be the cause of the conflicting currents shown in Fig. 4 of Mr. Royal-Dawson's letter?

It is stated that on pressing the cover-glass the bubble seems to increase in size. From this we may conclude that it is in contact with the glass surfaces top and bottom. It will therefore be more or less anchored. The result of this is that if it is to move it can only do so by the formation of new film on the front, or by the old film which is collecting in the rear from the top and bottom of the bubble moving to the front. As water offers

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